APS

10CFR50.73

Palo Verde Nuclear Generating Station

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192-01124-GRO/SAB/DJS
September 19, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS) Unit 3
Docket No. STN 50-530
License No. NPF-74
Licensee Event Report 2003-004-00

Attached please find Licensee Event Report (LER) 50-530/2003-004-00 that has been prepared and submitted pursuant to 10CFR50.73. This LER reports the Unit 3 Reactor Trip with loss of Forced Circulation due to an Electrical Grid Disturbance on July 28, 2003.

In accordance with 10CFR50.4, a copy of this LER is being forwarded to the NRC Regional Office, NRC Region IV and the Resident Inspector. If you have questions regarding this submittal, please contact Daniel G. Marks, Section Leader, Regulatory Affairs, at (623) 393-6492.

Arizona Public Service Company makes no commitments in this letter. The corrective actions described in this LER are not necessary to maintain compliance with regulations.

Sincerely,

David Mauldin
for G.R. Overbeck

GRO/SAB/DJS/kg

Attachment

cc: Regional Administrator – NRC Region IV (all with attachment)
N. L. Salgado
M. B. Fields

IE22

NRC FORM 366 (7-2001)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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4. TITLE

REACTOR TRIP WITH LOSS OF FORCED CIRCULATION DUE TO AN ELECTRICAL GRID DISTURBANCE

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
07	28	2003	2003	- 004	- 00	09	19	2003	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	1
10. POWER LEVEL	98

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)	xx	50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER - Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Daniel G. Marks, Section Leader, Regulatory Affairs	623-393-6492

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 28, 2003, Unit 3 was in MODE 1. At approximately 18:54 Mountain Standard Time (MST), a sub-synchronous relay Lockout Trip was received during a grid perturbation resulting in a Main Turbine Trip. The reactor tripped from approximately 98% power on a Core Protection Calculator generated anticipatory Low DNBR Trip (Reactor Coolant Pump speed coast-down) when the automatic Fast Bus Transfer did not successfully transfer house loads back onto offsite power sources. Fast Bus Transfer logic prevented transfer due to momentary low voltage on the alternate supplies as a result of the fault. The subsequent loss of the 13.8kV non-class busses resulted in a loss of power to non-safety related AC buses. Another local utility, (Salt River Project) was performing switching operations in the Hassayampa Switchyard just prior to the grid disturbance. A human performance error left a grounding switch closed during the switching operation and a three-phase fault to ground occurred on the Hassayampa to Arlington Valley 500kV line, relaying off area power plants, including PVNGS Unit-3.

The Control Room Supervisor diagnosed this event as a Loss of Forced Circulation, and the appropriate Emergency Operating Procedure (EOP: LOOP/LOFC) was entered. No Emergency Plan classification was required. On July 29, 2003 at approximately 00:44 MST, RCP 1A was restarted, restoring forced circulation. RCP 1B was started a short time later. Unit 3 transitioned from the Loss of Forced Circulation EOP to the Mode 3 to Mode 5 Normal Operating Procedure.

In the past three years, the station has not experienced a Reactor Trip with loss of Forced Circulation due to an Electrical Grid Disturbance.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

1. REPORTING REQUIREMENT(S):

APS is reporting this condition pursuant to 10 CFR 50.73 (a) (2) (iv) (A) due to the automatic actuation of the reactor protective system (RPS) (EIIC Code: JC).

Pursuant to 10 CFR 50.72 (b) (2) (iv) (B), a notification was made to the headquarters operation officer on July 28, 2003 (reference ENS # 40029).

2. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The core protection calculator/control element assembly calculator (CPC/CEAC) (EIIS: JC) system monitors pertinent reactor core conditions and provides an accurate, reliable means of initiating a reactor trip. The CPC/CEAC system is an integral part of the Plant Protective System (EIIS: JC) in that it provides departure from nucleate boiling ratio (DNBR) and local power density (LPD) trips to the reactor protection system (RPS) (EIIS: JC). Trip signals are provided to the reactor protection system whenever the minimum DNBR or fuel design limit LPD is approached during reactor operation.

The RPS provides a rapid and reliable shutdown of the reactor to protect the core and the reactor coolant system pressure boundary from potentially hazardous operating conditions. Shutdown is accomplished by the generation of reactor trip signals. The trip signals open the reactor trip switchgear (RTSG) breakers (EIIS: AA), de-energizing the control element drive mechanism (CEDM) coils (EIIS: AA), allowing all CEAs to drop into the core by the force of gravity.

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3. INITIAL PLANT CONDITIONS:

On July 28, 2003, at approximately 18:54 Mountain Standard Time (MST), Palo Verde Unit 3 was in Mode 1 (POWER OPERATION), operating at approximately 98 percent power. There were no major structures, systems, or components that were inoperable at the start of the event that contributed to the event. There were no failures that rendered a train of a safety system inoperable and no failures of components with multiple functions were involved.

4. EVENT DESCRIPTION:

At approximately 18:54 MST on July 28, 2003, a generator Subsynchronous Oscillation (SSO) Lockout Trip (EIIS: JJ) was received during a grid perturbation resulting in a Main Turbine Trip. The reactor tripped from approximately 98% power on a CPC generated anticipatory Low DNBR Trip (Reactor Coolant Pump speed coast-down) when the automatic Fast Bus Transfer did not successfully transfer house loads onto the offsite power source. The subsequent loss of the 13.8kV non-class busses NAN-S01 and NAN-S02 (EIIS: EA) resulted in a loss of power to non-safety related loads including the 4 RCPs, miscellaneous cooling water systems and the instrument air compressors. The unit's safety related buses remained energized during and following the reactor trip.

Salt River Project (SRP) utility workers were performing switching operations in the Hassayampa Switchyard just prior to the grid disturbance. A human performance error left a grounding switch closed during the switching operation and a three-phase fault to ground occurred on the Hassayampa to Arlington Valley 500kV line, relaying off other area power plants and PVNGS Unit-3.

The Control Room Supervisor diagnosed this event as a Loss of Forced Circulation. EOP 40EP-9EO07 Loss of Offsite Power/Loss of Forced Circulation (LOOP/LOFC) was entered. No Emergency Plan classification was required.

On July 28, 2003, the NRC Operations Center was notified in accordance with 10CFR50.72(b)(2) of the event at 22:42 MST.

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At approximately 00:44 MST on July 29, 2003 RCP 1A was restarted, restoring forced circulation. RCP 1B was started a short time later. Unit 3 transitioned from the Loss of Forced Circulation EOP to the Mode 3 to Mode 5 Normal Operating Procedure.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

Plant performance during the reactor trip was as expected given a generator trip from 98 percent power, with no challenges to any safety function. Analysis of the available data indicates that the RPS (EIIS: JC) responded as designed to this event. A reactor trip was generated by a CPC (EIIS: JC) generated anticipatory Low DNBR Trip due to RCP speed coast-down, when the automatic Fast Bus Transfer was not successful. The trip occurred at the proper setpoint and was received within the required time frame.

Subsequent to the reactor trip, the plant responded as designed, the reactor trip was uncomplicated, no safety limits were exceeded, and the event was bounded by current safety analyses. Primary and secondary pressure boundary limits were not exceeded as a result of the reactor trip. The transient did not cause any violation of the safety limits (i.e., departure from nucleate boiling ratio, linear heat rate, pressurizer pressure). Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or health and safety of the public and there were no conditions during this event where the fulfillment of the safety function would not have been met.

The condition would not have prevented the fulfillment of any safety function and did not result in a safety system functional failure as defined by 10CFR50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

APS has concluded that the trip was initiated by a subset of relays called the instantaneous transient torque (ITT) relays in the unit's subsynchronous oscillation (SSO) relay protection scheme (EIIS: JJ). There are two SSO relays per unit. Each relay has four (4) frequency modules and four (4) ITT modules.

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These relays monitor the overall magnitude of turbine-generator transient shaft torque (by indirectly looking at the generator electrical torque). All eight of the ITT relay modules actuated instantaneously at their setpoint. Unit 3's SSO relays are intentionally set at a higher sensitivity than the Unit 1 and 2 relays to preclude multi-unit trips for the same grid event. When both SSO relays tripped, a trip signal was sent simultaneously to the 525kV generator output breakers, the turbine trip logic, the generator exciter, the auxiliary transformer breakers E-NAN-S01A and S02A, and a close permissive was sent for the E-NAN-S03B and S04B breakers. These last two actions initiate fast bus transfer (FBT)(EIIS: ASU) at E-NAN-S01 and E-NAN-S02.

FBT failed to transfer the unit house load from the unit auxiliary transformer to the offsite source. Beckwith high speed synch check relays monitor the condition of the voltage coming from the unit auxiliary transformer and the offsite power source and permit the transfer to occur only if certain voltage and phase angle criteria are met. There is another undervoltage relay (227-1) at NAN-S03/S04 that also monitors the offsite power system voltage. If the unit auxiliary transformer breaker (S01A/S02A) is beginning to open (an early 'b' contact closes), the Beckwith relay gives its permissive, and the 227-1 relay sees adequate voltage, the offsite breaker (S03B/S04B) will close and restore power to NAN-S01 and S02 without loss of any of the loads on S01 or S02.

It appears that the relaying and FBT schemes performed as designed. However, the preliminary assessment is that there may have been a very brief opportunity where FBT could have been successfully accomplished. This failure to transfer appears to be due to the setpoint of the 227-1 relay for this type of transient fault condition. This 227-1 relay performs several functions associated with main generator tripping schemes. It also has one that is intended to block fast bus transfer if a transfer could cause a degraded voltage condition at the associated class 1E 4160V bus. The 227-1 relay has a contact in series with the Beckwith relay permissive signal. This contact blocked the Beckwith signal thus preventing successful accomplishment of FBT. The unit's safety related buses remained energized during and following the reactor trip.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event.

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7. CORRECTIVE ACTIONS:

Control room personnel took immediate action to place the reactor in a stable condition in accordance with the appropriate operating procedures.

APS is evaluating modification options to make the generator protection logic system more fault tolerant to prevent recurrence.

Any additional corrective actions taken as a result of the investigation of this event will be implemented in accordance with the APS corrective action program. If information is subsequently developed that would significantly affect a reader's understanding or perception of this event, a supplement to this LER will be submitted.

8. PREVIOUS SIMILAR EVENTS:

In the past three years there have been no similar events where a Palo Verde Generating Unit experienced a Reactor Trip with loss of Forced Circulation due to an Electrical Grid Disturbance.

9. ADDITIONAL INFORMATION:

As a result of the Unit 3 trip, an RCS leak of approximately 1.7 gallons per minute was identified as coming from the Reactor Coolant Pump 2A seal. This leakage was characterized as "Identified Leakage" in accordance with the Technical Specification Definition for Identified Leakage. Vacuum was restored to the main condenser and the plant was cooled down to Mode 5, Cold Shutdown using the steam bypass control system. After reaching Mode 5, the RCP 2A pump seal was replaced and the leak was terminated.